Benign Paroxysmal Positional Vertigo

Cupulolithiasis and Atypical BPPV

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Survey Questions
Benign Paroxysmal Positional Vertigo (BPPV)

- Most common cause of vertigo in peripheral vestibular disorders
- Accounts for more than 50% of people over 65 with dizziness
- Most common complaint is dizziness with positional changes
  - Imbalance
  - Lightheaded
  - Gait disturbance
  - Nausea
- Increased risk for falls

Prevalence

- 10.7 - 64 / 100,000 population
- 2.4% lifetime
- Estimated cost of $2000 to arrive at diagnosis
- Total healthcare cost for BPPV / year: $2 billion
- Estimated that 86% of patients suffer interruption of ADL’s and lost work time due to BPPV
What is Balance?

➢ A complex biological function that relies on sensory inputs from the visual, proprioceptive, and vestibular systems that converge towards the vestibular nuclei, where they are integrated and result in the induction of oculomotor and postural stabilization synergies.

➢ Comprised of three sensory systems:
  ➢ Visual
  ➢ Somatosensory
  ➢ Vestibular

System Integration for Balance

<table>
<thead>
<tr>
<th>Surface</th>
<th>SOM</th>
<th>VEST</th>
<th>VIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stable</td>
<td>70%</td>
<td>20%</td>
<td>10%</td>
</tr>
<tr>
<td>Unstable</td>
<td>60%</td>
<td>30%</td>
<td>10%</td>
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</tbody>
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Vestibular System

➢ Provides information about the movement of the head and its position with respect to gravity and other inertial forces.

➢ Contributes important information to the sensation and perception of the motion and position of the body as a whole.

➢ The vestibular system participates in the maintenance of stance and body posture; coordination of body, head, and eye movements; and visual fixation.
Anatomy and physiology of the Vestibular system

Vestibular Anatomy

➢ The bony labyrinth contains auditory and vestibular organs
➢ The membranous labyrinth is within the bony labyrinth
➢ CN VIII
Membranous Labyrinth

- 3 semicircular canals
  - anterior, posterior, and horizontal
  - Primarily sense angular acceleration
  - Aligned at right angles to one another with the horizontal canal sloping down 30°

- 2 otolithic organs
  - Saccule = vertical plane
  - Utricle = horizontal plane
  - Primarily sense linear acceleration and head tilt

Vestibular Anatomy

Semicircular Canals

- Provides sensory input about head velocity, enabling the VOR to generate an eye movement equal in velocity to the head (stabilizing the eyes for clear vision)
- Contains endolymph
- Coplanar pairing / sensory redundancy
- Push-pull relationship
Semicircular Canal Orientation

Macula of the Otolithic Organ
- Each macula contains a jelly-like bed of the otolithic membrane
- Otolithic membrane is embedded with calcium carbonate crystals called otoconia
- The otoconia increase the specific gravity causing the otolithic organs to be responsive to the static pull of gravity

Crista of the Semicircular Canals
- Contains the cupula and the ampullary crest
- The cupula is attached at the top and bottom of the canal and acts like a sail
- Endolymph will push or pull on the cupula, which generates a nerve impulse to the ampulla
- Endolymph is the same density as the cupula, allowing for a push or pull
**Ampulla Hair Cell**

- Sensory cells that transduce mechanical forces into nerve action potentials
- Bundles of one tall kinocilium and multiple (50-100) stereocilia
- When stereocilia bend towards kinocilium, the hair cell is depolarized (excitation)
- When stereocilia bend away from kinocilium, the hair cell is hyperpolarized (inhibition)

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**BENIGN PAROXYSMAL POSITIONAL VERTIGO (BPPV)**

**Cupulolithiasis**

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**Causes of BPPV**

- Under the age of 50
- Head injury is most common cause
- Over the age of 50
- Idiopathic
- Most common onset between 50 – 70 years
- Other potential causes
- Degeneration
- Prolonged Positioning
- Viral
Signs & Symptoms of BPPV
- Dizziness with positional changes
  - rolling over in bed
  - quick head turns
  - bending over
- Nausea due to excessive dizziness
- Loss of balance with gait
- Sense of “floating” or “swimming”
- Initial onset may produce severe spinning dizziness lasting hours and nausea / vomiting

Forms of BPPV
- Canalithiasis
- Cupulolithiasis

Cupulolithiasis
- Least common
- Onset of vertigo/nystagmus is immediate (1 – 2 seconds)
- Symptoms persist > 60 seconds or as long as the patient is in the provoking position
Cupulolithiasis

- **Mechanism**
  - Otoconia from the utricle adhere to the cupula and increase the density of the cupula. This causes an inappropriate deflection of the cupula when the head and affected ear are positioned below the horizon. This sends an abnormal signal resulting in dizziness.
  - Otoconia can be attached to canal side or utricle side of the cupula.

Canal Involvement

- **Posterior:** > 80%
- **Horizontal:** 10 – 12%
- **Multi – canal:** 5%
- **Anterior:** 2%
- Diagnosis is made from direction and duration of nystagmus.
Evaluation

Subjective

- Chief Complaint / Hx of Illness
- Onset
- Conditions provoking symptoms
- Duration / Severity (of initial onset and of subsequent episodes)
- Fall History
- Limitations in ADL’s
- Previous Medical History
- Previous Medical / Vestibular Testing

Information that you get from your subjective evaluation should drive the objective evaluation

Evaluation

Objective
BPPV Testing

- Dix – Hallpike
- Roll Test
- Head Hanging

Dix-Hallpike

- Patient MUST keep eyes open and stay in provoking position
- Important to explain procedure thoroughly and the expected results
- Use Frenzel lenses if possible (block vision)

Dix-Hallpike

- Turn patient head (or body) 45 degrees to side being tested
- Support patient shoulder with your forearm
- Have patient lie down as quickly as possible
- Extend neck 30 degrees
- Have patient focus on target (tip of nose) to keep eyes still, unless using lenses
Dix-Hallpike Video

Frenzel or Infrared Lenses
- Allows eye movement to be seen while blocking the vision of the patient
- Visual system has the ability to override the vestibular system, so you may not see eye movement without vision blocked

Results
- Posterior Canal
  - Upbeating, torsional nystagmus to affected side
- Anterior Canal
  - Downbeating, torsional nystagmus to affected side OR downbeating
- Horizontal Canal
  - If horizontal nystagmus is seen, should confirm with a roll test
**Roll Test**

- Patient MUST keep eyes open and stay in provoking position
- Patient will experience vertigo and nystagmus in both directions due to debris moving back and forth within the canal

Roll Test

- Patient lies supine with neck flexed 30 degrees to position horizontal canal perpendicular to horizontal plane
- Turn head 90 degrees to affected side as quickly as possible
- Have patient focus on target (tip of nose) to keep eyes still
- Repeat to other side
- If patient is unable to turn head 90 degrees, have them turn body to achieve 90 degrees
- Affected side is the side with the weaker nystagmus
Roll Test Video

Testing Results
- Canalithiasis
  - Geotropic nystagmus (beating towards the ground)
  - Cupulolithiasis
    - Ageotropic nystagmus (beating away from the ground)

Ageotropic Nystagmus Video
Atypical BPPV (AC)

➢ Dix Hallpike testing may be difficult to interpret, and you may not see nystagmus at all
➢ Downbeating nystagmus
➢ Positive findings may be evoked in both head right and head left positions, but may also get false negatives

Atypical BPPV

➢ Ampullary segment of AC is roughly vertical (70°)
➢ If test is negative, need to test with the straight head hanging position
➢ Adds additional 20° of cervical extension, which allows otoconia to clear the curve of the vertical segment

Head Hanging

➢ Patient lies straight back and head is extended fully
➢ Positive test will show downbeating nystagmus
➢ Cannot always determine affected side
Head Hanging

Downbeating Nystagmus Video

Reversal of nystagmus

- Upon return to starting position, or if head is placed in opposite position, the reversal of the nystagmus should be seen
- Due to deflection of cupula in the opposite direction
Treatment

BPPV

- Cupulolithiasis
- Semont Maneuver (Liberatory)
- Modified Semont by Casani for horizontal cupulolithiasis
- Cupulolith Repositioning Maneuver (CuRM)
- Brandt-Daroff
- Other treatments
  - Head tilt Hopping
  - Cranial Oscillation

Cupulolithiasis

- Semont Maneuver (Liberatory Maneuver)
- Works by floating the debris through the canal, or dislodging debris from the cupula
Semont Maneuver

➢ Posterior Canal
  ➢ Patient head is rotated 45 degrees to unaffected side
  ➢ Patient lies down quickly on to the affected side
  ➢ Position is held for 2 – 3 minutes
  ➢ Patient is then moved rapidly through the sitting position to the opposite side with the head remaining in the same position
  ➢ Nystagmus and dizziness should occur in this position
  ➢ If not, the head is shaken abruptly (small amplitude) once or twice to free the debris
  ➢ Patient remains in this position for 5 minutes
  ➢ Patient then sits up

Semont Maneuver

➢ Anterior Canal
  ➢ Patient head is rotated 45 degrees to affected side
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  ➢ Patient remains in this position for 5 minutes
  ➢ Patient then sits up

Semont Maneuver

➢ 58% effective after 1 week
➢ Believed to be due to performing maneuver incorrectly by patients on their own
Semont Maneuver Video

Modified Semont by Casani
- Horizontal Canal
  - Patient sits with head in midline
  - Patient lies down quickly to affected side
  - Head is immediately rotated 45 degrees to affected side
  - Hold for 2 minutes
  - Patient sits up slowly and head is returned to midline

Modified Semont by Casani
- 80% effective after 2 treatments
- 90% effective after 3 treatments
Cupulolith Repositioning Maneuver (CuRM)

➢ Treats when otoconia are attached to either canal side or utricle side
➢ Patient begins in supine position
➢ Head and body are rotated to affected side 135 degrees and oscillation is performed to mastoid bone for 30 seconds
➢ Head is rotated 45 degrees to the unaffected side
Cupulolith Repositioning Maneuver (CuRM)

- Patient is rotated to unaffected side to supine position
- Head and body are then rotated 90 degrees to unaffected side
  - If nystagmus occurs, then otoconia are likely on utricle side and oscillation is again required on the mastoid bone for 30 seconds
- Head and body are then rotated another 90 degrees to unaffected side
- Patient sits up (do not allow neck extension)

Each position is held for 3 minutes

Cupulolith Repositioning Maneuver (CuRM)

- Research suggests patient should sleep on unaffected side after treatment to prevent recurrence
- 97% effective after 2 treatments
Brandt-Daroff

- Brandt-Daroff
  - Believed to help through habituation
  - Unknown how crystals reposition
  - Patient must perform quickly
  - Exercise should be performed 3 times daily until patient is free from vertigo/dizziness for 48 hours

Brandt-Daroff

- Posterior Canal
  - Head is turned 45 degrees to the unaffected side
  - Patient lies down quickly to the affected side
  - Position is held for 30 seconds AFTER dizziness passes
  - Patient then sits up and holds position for 30 seconds AFTER dizziness passes
  - Head is then rotated 45 degrees to the affected side and the patient lies down quickly to the unaffected side
  - Position is held for 30 seconds AFTER dizziness passes
  - Patient repeats this procedure 10 times to each side
  - Patient should remain upright for at least 3 hours after treatment

Brandt - Daroff

- Anterior Canal
  - Head is turned 45 degrees to the affected side
  - Patient lies down quickly to the affected side
  - Position is held for 30 seconds AFTER dizziness passes
  - Patient then sits up and holds position for 30 seconds AFTER dizziness passes
  - Head is then rotated 45 degrees to the unaffected side and the patient lies down quickly to the unaffected side
  - Position is held for 30 seconds AFTER dizziness passes
  - Patient repeats this procedure 10 times to each side
  - Patient should remain upright for at least 3 hours after treatment
Brandt-Daroff

- Horizontal Canal
  - Head remains in midline
  - Patient lies down quickly to the affected side
  - Position is held for 30 seconds AFTER dizziness passes
  - Patient then sits up and holds position for 30 seconds AFTER dizziness passes
  - Patient then lies down quickly to the unaffected side with head remaining in midline
  - Position is held for 30 seconds AFTER dizziness passes
  - Patient repeats this procedure 10 times to each side
  - Patient should remain upright for at least 3 hours after treatment

Head tilt Hopping

- Developed from idea of using jumping to eliminate urinary stones
- Performed by tilting head to affected side and hopping up and down 20 times
- Data:
  - Effective for 70.4% of treated patients after 4 weeks
Cranial Oscillation

➢ Research on patients with Meniere’s Disease
➢ Additionally shown to detach otocoria from cupula
➢ Performed with patient sidelying on unaffected side
➢ Vibration placed on mastoid bone for 20 minutes
➢ Patient lies in same position for an additional 30 minutes after treatment
➢ Used when all other methods are ineffective

Key things to remember

➢ Positions must be performed quickly to dislodge otocoria from cupula
➢ May take more than one treatment
➢ Use of vibration can help to dislodge otocoria
➢ Need to retest after treatment
  ➢ May convert to canalithiasis

Cervical Restrictions

➢ Patients with cervical restrictions can be turned on their side and tilted with a table or laid back on a wedge to achieve the testing and treating positions
➢ Canals just need to be positioned relative to gravity
Precautions / Contraindications

➢ History of neck surgery (P)
➢ Recent neck trauma (C unless cleared)
➢ Severe Rheumatoid Arthritis (C)
➢ Atlantoaxial / Occipitoatlantal (C1 – C2) instability (C)
➢ Cervical myelopathy / radiculopathy (P)
➢ Chiari Malformation (C)
➢ Vascular Dissection Syndromes (C unless cleared)

Post Maneuver Restrictions

➢ Previous
  ➢ Sit / sleep upright for 48 hours
  ➢ Avoid any provoking positions for 48 hours
➢ Current
  ➢ Sit upright for 15 minutes to avoid canal conversion

Surgical Options

➢ BPPV
  ➢ Singular Neurectomy: removal of all or part of the nerve
  ➢ Surgical Blockade (canal “plugging”): bone plugs placed in affected canal to block function without affecting other canals
Secondary BPPV

- Meniere’s Disease: 65 – 70% between attacks
  - More common recurrence
- Vestibular Neuritis: 9.8 – 20%
- Sudden sensorineural hearing loss: 12.7%
- Head trauma: 6.6% [25% more likely to be bilateral]
- Post-surgical: 6.3 – 8.5%
  - Dental
  - Cochlear Implants
- Migraine
  - Poorly understood

Recurrence

- 9 – 30% of patients will have a recurrence within first year
- May not be in the same canal
- No time frame associated with recurrence
- May return as a canalithiasis

Recovery

- Many patients have complete resolution of symptoms in one treatment
- Some require several treatments
- Possible to have “canal sensitivity” after repositioning
  - Lightheaded
  - Imbalance
Recovery
➢ Should always treat balance deficits after BPPV
   ➢ firm surface
   ➢ foam surface
   ➢ ambulating
➢ Be sure to test for BPPV on follow up visits
   ➢ Many times cupulolithiasis is converted to a canalithiasis after treatment

Documentation
➢ Medical Diagnosis
➢ Therapy Diagnosis
➢ Goals need to relate to function
➢ Clear objective evaluation

Billing & Coding
➢ Coding for BPPV
   ➢ Right ear
     ➢ ICD-10 code = H81.11
   ➢ Left ear
     ➢ ICD-10 code = H81.12
   ➢ Bilateral
     ➢ ICD-10 code = H81.13
➢ Coding for Dizziness / Giddiness
   ➢ ICD-10 code = R42
Billing & Coding

➢ Vestibular rehab / balance rehab
  ➢ Neuromuscular re-education
  ➢ Balance, coordination, kinesthetic sense, posture, proprioception
  ➢ CPT code = 97112

➢ Therapeutic Activities
  ➢ Functional activities
  ➢ CPT code = 97530

➢ Gait Training
  ➢ Training of biomechanical & kinesiological components of walking including balance
  ➢ CPT code = 97716

➢ Billing for BPPV
  ➢ Canalith repositioning procedure – i.e. Epley maneuver, Semont maneuver
  ➢ CPT code = 95992

➢ ***MUST HAVE DIAGNOSIS OF BPPV TO BE REIMBURSED***

Questions?

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